Petrological Abstracts and Reviews

Edited by ALBERT JOHANNSEN

KOENIGSBERGER, JOH. *Erläuterungen zur geologischen und mineralogischen Karte des östlichen Aaremassivs von Disentis bis zum Spannort.* Freiburg i. B. und Leipzig: Speyer & Kaerner, 1910. Pp. 63; figs. 8; colored geological map in pocket.

This work is a geological description of a small portion of the Alps, $12 \times 26\frac{1}{2}$ km. in extent, between Disentis and Spannort, and just north of St. Gotthard. It is mapped on a scale of 1 cm. to 500 m., on one of the beautiful maps of the Swiss Topographic Bureau in Berne.

The author tentatively submits the following sequence:

1. Deposition of pre-Carboniferous sediments. These were much altered by the later intrusives and are now chiefly sericite gneiss.

2. Intrusions of diorite, diorite porphyrite, diabase, and gabbro-peridotite into Silurian and Devonian rocks. The intrusives are almost entirely altered to amphibolites but the original rocks in most cases can be determined. The diorites are accompanied by differentiation zones of diorite-aplite.

3. Intrusions of gneiss, probably originally granite, into upper-Devonian rocks, and forming a low-arched laccolith. By this intrusion the former eruptives and the sediments were metamorphosed into crystalline schists.

4. Intrusions of syenite, followed by biotite and hornblende granite (Piz Ner), of middle or upper Carboniferous age.

5. Intrusion of the Aar granite at the contact and beneath the previously intruded syenite. In places fragments of the latter are inclosed in the former. Contemporaneously with the intrusion came the Carboniferous folding, seen in the Wendeljoch.

6. The Jura-Trias folding and thrust faulting of the Alps followed next and produced further metamorphism. Nowhere are there exposed in the Aar massif any contemporaneous intrusives.

The rocks are briefly described, numerous analyses are given, and the contact effects are shown. The mineral localities are described, seven excursions are outlined; and complete literature references are given.

ALBERT JOHANNSEN

FARRINGTON, OLIVER CUMMINGS. *Meteorite Studies, III.* Publication No. 145, Geological Series, Vol. III, No. 8. Field Museum of Natural History, Chicago, 1910.

The publication includes: Description of a chondritic meteorite which fell near Leighton, Ala., on January 12, 1907; description of a large iron meteorite found at Quinn Canyon, Nev., in 1908; a collection of analyses of taenite; a tabulation of the well-authenticated times of fall of meteorites since 1800, compared for years, months, days, and hours of the day; and a list of the meteorites of the United States, arranged by states.

E. R. LLOYD

ROSENBUSCH, H. *Elemente der Gesteinslehre.* Third revised edition with 692 pp., 107 figures, and 2 plates. Stuttgart, 1910.

The appearance of a new edition of this standard textbook is a matter of more than ordinary interest since it represents in briefer form the results of the petrographical investigations of the last decade as summarized in the fourth edition of Rosenbusch's *Massige Gesteine.* The fact that the larger and smaller works follow the same general analysis makes the latter especially satisfactory as a textbook for advanced students who can use it.

The new edition has been thoroughly revised and, where necessary, enlarged by the incorporation of new material. The amount of such additional material is much less than might be inferred by an increase of nearly 150 pages which is due in a measure to the resetting of the work. Certain changes in classification, the firmer drawing of the systematic lines, an improvement in proportion (due to the fuller treatment of formerly neglected features), and the introduction of additional chemical data are the chief changes noted. There still remain, however, several changes which might be made to increase the logical coherence of the systematic treatment and the completeness of the chemical discussion.

The book, as in former editions, consists of three parts, dealing respectively with the eruptive (70 per cent), sedimentary (13 per cent), and metamorphic (17 per cent) rocks, preceded by an introduction.

The "introduction" remains practically unchanged except for the substitution of the new average for the composition of rocks obtained by Clarke and a brief discussion of the cone-in-cone structure.

Part I, "The Eruptive Rocks," following the earlier analysis, considers them from the viewpoint of their substance, geological occurrence,

texture, age, metamorphism, and classification. Three additions of moment are noted. These are discussions of (1) gases, based principally on the work of Gautier without reference to that of R. T. Chamberlin; (2) the relation of size of grain to the temperature in a cooling intrusive mass, based on Professor Lane's paper; (3) applicability of the phase rule to the complex hydrous and gaseous solutions of more or less dissociated material of the magma which is not an arbitrary mixture but such that when computed water free contains 184 molecules.

The systematic description of the igneous rocks divides them into three major groups—deep-seated, dike, and effusive—as formerly. The groups, in turn, are divided into 10 families, three subgroups, and 14 families respectively. Each family is described with respect to its mineral and chemical composition, texture, subdivision, geological occurrence, and distribution.

The discussion of *deep-seated rocks* shows careful revision and the incorporation of many of the results of the recent investigations. The systematic treatment is conspicuously modified by placing the discussion of the Peridotites last and by the expansion of the chapter on Ijolite and Missourite into two chapters entitled "Missourite and Fergusite" and "Ijolite and Bekinkinite." Less conspicuously there is introduced the far more fundamental conception of the division of the deep-seated rocks into three great series by the elevation of the Charnockite-Maugerite-Anorthosite series to equal rank with the better known alkali and alkali-lime series. The new series is characterized as follows:

Charnockite-Anorthosite Series.—The rock series based upon gradations in composition and association in the field passing from Granite through Syenite and Diorite to Gabbro—the lime-alkali series—and that from alkali granite through alkali syenites to Essexites, the alkali analogue of the gabbro—the alkali series—have been well recognized. There have, however, in these series been certain members lacking, e.g., the alkali analogue of the Diorite and the lime-alkali analogue of the Nephelite syenite.

Each of the series has its own areas of occurrence and the different members of a series are usually intimately related in occurrence while members of the alkali series never occur in regions of lime-alkali rocks.

We find now among the Plutonic rocks, a type whose mineral composition is of the same sort as the gabbro—the anorthorite and labrador fels—which, notwithstanding its chemical character and association, varies throughout from the gabbro. This anorthorite type we find in association with the hypersthene granite or charnockite, and here, moreover, the silica-rich charnockite is connected by a number of intermediates with the silica-poor anorthosites, so that we may speak of a charnockite-anorthosite series which even has peridotite or pyroxenic end members. . . . .

The number of occurrences of rocks of the charnockite series is, on the

whole, not as great as those of the other two series and especially the intermediate members between the charnockite and the anorthosite are as yet but little studied.

The series includes charnockite, maugerite, anorthosite, and kyschtymite, and is represented in Canada, Norway, Russia, Saxony, and the type locality of Madras described by Holland.

The analyses show with a rise in silica a decrease in anorthite and, when this is over 56 per cent, the content of the alkalies, producing microperthites, rises rapidly at the cost of the lime-soda feldspars until the granitic type of the series is reached.

The uncertain touch in handling this new series is striking evidence of the evils of combining the elements of genesis and composition in a systematic presentation of rocks. Either the integrity of the series rests upon the chemical similitude of its members or in their genetic association. It cannot rest on both as of equal supporting value. From the treatment of this new series by Rosenbusch it is impossible to credit him with a clear concept without charging him with serious defects in revision. The series is introduced incidentally (p. 182) without any forecasting of its existence in the general discussion or in that of the granites where a typical member of the new series (Hypersthene granite from Birkem) is cited as a member of the alkali-lime granites, at least by implication. Moreover, charnockite itself is described briefly (p. 94) without reference to the new series, while the index to the volume itself shows no reference to its discussion on p. 182. That it is possible to erect a new series may be seen from a study of Osann's analysis, since rhyolite, micatrachyte, dacite, amphibole-andesite, aplite, granite, and alaskite show the chemical characteristics assigned to the series, viz., relatively high alumina, lime, and the alkalis, low iron, magnesia, and varying silica.

The discussion of the Essexites, the Shonkinites, and other "basic alkali" deep-seated rocks has been entirely rewritten and expanded by embodying the results of the studies of Hibsch in Bohemia, Lacroix in Madagascar, and others in different areas.

The chemical discussion at the end of the chapter on the deep-seated rocks is enriched by the graphic representation of the analyses according to the scheme proposed by Osann and by a short tentative discussion of the molecular character of the magmas.

The discussion of the *dike rocks* is little changed from that of earlier editions. A slight modification in terminology from granite porphyry to *granito-porphyritic* is noted at the beginning but not consistently followed, and the introduction of granito-porphyritic rocks equal to the alkaline and basic alkaline rocks has been made to improve the symmetry

of the discussion. The treatment of the eleolite-porphyries has been rewritten and a section describing the monzonite and shonkinite-porphyries has been added. The fine-grained rocks are divided as formerly into aplitic and lamprophyric series, the former subdivided on the basis of habit, the latter on the geological association and ferro-magnesian constituents. Much of this description has been rewritten. The additional section on the camptonitic, monchiquitic, and alnoitic rocks emphasizes their genetic and geological association with the deep-seated rocks of the alkali series and this relationship is accentuated by the introduction of a number of analyses and an Osann diagram.

The discussion of the *effusive rocks* has largely been rewritten with a marked increase in the chemical descriptions which are supplemented by the introduction of many new analyses. The chief changes of viewpoint occur in the expansion and elaborated classification of the alkali rocks and in the addition of a lamprophyric group of effusive rocks analogous to those distinguished among the dike rocks. The keratophyres are now classed with the porphyries of the lime-alkali series because of their geological association, although it is recognized that by mineralogical and chemical composition they are often practically identical with rocks of the alkali series.

The section on the *trachyandesites* is entirely rewritten and the line of separation between them and the normal dacites and andesites is emphasized by the introduction of numerous analyses and an Osann diagram. The treatment of the *basalts* and *melaphyres* remains with little modification, the author still holding to the distinction of the 3 types on the basis of age, although the citation of examples, e.g., the Mesozoic diabases of the United States, is manifestly contrary to the basis of classification adopted. The correlation of the trachydolerites as the effusive form of the essexite-magma is no longer maintained, the view being expressed that their systematic position must be postponed pending the accumulation of additional information.

The lamprophyric effusive rocks are characterized by their low content of alumina and the almost constant predominance of magnesia over lime. The erection of this new division is based upon the conception that the surface equivalents of the more acid rocks are really more aplitic in their composition and that one would naturally expect to find analogous lamprophyric equivalents as well. To this division are assigned the verite, fortunite, and jumillites of Osann, the orendite-madupite group (and Prowersite) of Cross, the euktolite, coppaelite, absarokite, selagite, and sanukite.

Part II, devoted to the "Sedimentary Rocks," remains practically

unchanged beyond minor additions to bring the work up to date. The treatment of the carbonate rocks is somewhat expanded by a discussion of the *marls*, and the origin of *oölites*, and the origin of *dolomites*. The origin of the oölitic iron ores is also discussed in an additional section. The changes in organic matter by which coal and oil are formed are classified in accordance with Potonié's recent paper.

Part III. The third part, dealing with the "Crystalline Schists," has been thoroughly revised and brought down to date without any serious modification. Greater emphasis is laid on the chemical composition as an indication of the character of the original rock and here and there the discussion is an application of physical-chemical conclusions to the interpretation of the phenomena. Reference is made to the schistosity developed by crystallization under pressure as described by Riecke and the terminology is modified by the introduction of the terms proposed by Becke. In the descriptive portion no change is made in the systematic treatment, beyond the introduction of a few new names, such as the *myrmekite* of Sederholm, the *astochite-gneiss* of Belowsky, and the *sagvaudite* of Pettersen.

While the book as a whole is probably the best elementary textbook in descriptive petrography because of the clear style and comprehensive treatment of the subjects, it must be regarded as falling short of the ideal in the minds of all who find occasion to criticize the continental viewpoint, which has in large measure been developed through the writings and teachings of Rosenbusch. The criticisms against the validity of the dike rocks and the Kern theory are too well known to need restatement. There are, however, numerous inconsistencies in the systematic carrying-out of the underlying views which should be eliminated. For example, the element of age is discarded in the general discussion but frequently appears in the definitions or descriptions of the various rocks. There is likewise ground for criticism in the combined use of geological and petrographical criteria in classification which leads to the separating of rock like the keratophyres from the alkali rocks from which they are admittedly indistinguishable in chemical and mineralogical composition and in texture. A third criticism in systematic treatment is that already referred to in the handling of the charnockite and anorthosite series and the relative disregard of the silica content in the chemical discussion by the use of the Osann diagrams. It is a subject for regret that this excellent textbook cannot be translated and still more that there is no equally satisfactory work by an American author.

EDWARD B. MATHEWS